

BROAD AGENCY ANNOUNCEMENT NR: 01-06-VAK
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**CBD ANNOUNCEMENT NR:
Broad Agency Announcement (BAA) NR: 01-06-VAK**

TITLE: Collaborative Research in Control Science

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PROPOSAL DUE DATE AND TIME: 31 July 2001, 4:00 P.M. local time. ***NOTE:*** *Proposal receipt after the due date and time shall be governed by the provisions of FAR 52.215-1(c)(3).*

INTRODUCTION:

Air Force Research Laboratory, Air Vehicles Directorate, Wright Research Site is soliciting technical and cost proposals on the research effort described in Section A below. Proposals should be addressed to the Contracting Point of Contact (POC) stated above. This is an unrestricted solicitation. Small businesses are encouraged to propose on all or any part of this solicitation. Proposals submitted shall be in accordance with this announcement. *There will be no other solicitation issued in regard to this requirement.* Offerors should be alert for any BAA amendments that may permit extensions to the proposal submission date.

Potential offerors are notified that effective 01 Jun 1998, in order to be eligible to receive any DOD award, contractors must be registered in the Central Contractor Registration (CCR) Database, unless a contractor meets any of the exceptions of DFARS 204.7302. On-line registration instructions can be accessed from the Wright Research Site Contracting Office home page at <http://www.wrs.afrl.af.mil/contract/> or the DISA CCR home page at <http://www.ccr2000.com/>.

SECTION A: Statement of Problem/Objective:

1. Statement of Objective/Needs:

The Control Theory Optimization Branch (AFRL/VACA) is the Control Science Center of the Air Force Research Laboratory's Air Vehicles Directorate. Our Center is active in conducting basic and applied research under AFOSR and directorate sponsorship in the broad area of dynamics and control. The Center is internationally known for its technical contributions and its ability to transition the technology to the warfighter. Areas of current interest include cooperative control of groups of unmanned air vehicles and satellites, control of reusable, hypersonic launch vehicles, and aerodynamic flow control. The research goals for each of these areas are described in the following paragraphs.

Groups of unmanned air vehicles and clusters of satellites represent multi-agent systems in which many independent systems interact in a common environment. Each can be autonomous or arranged in a hierarchy. Such systems have the

advantages of simplicity, robustness, and flexibility. The primary challenge is to design a decentralized control system for these multi-agent systems. The individual elements of such a system are nominally interchangeable, and are more limited when used individually. A decentralized control theory is desired that describes how the system performance is to be achieved with distributed components. This includes a hierarchical structure if needed, system performance decomposition, coordination strategy, local sensor vs global sensor information, stability, and complete or restricted communication. System tasks will focus on formation management, reconfiguration, collision avoidance, cooperative attack, cooperative search, and rendezvous. In each case, the goal is to achieve the desired group behavior using a large number of basically identical, decentralized control systems that cannot be achieved through a large centralized control system because of the impracticality and inflexibility of such a system.

Toward the U.S. Air Force goal of reliable, affordable access to space with quick turn-around time, the hypersonic research area focuses on developing an adaptive guidance and control law for an autonomous hypersonic vehicle. The adaptive control law allows the vehicle to maintain the feasible trajectory under control effector failures. Under severe failures, the nominal trajectory may become infeasible. An adaptive guidance algorithm is then needed for on-line trajectory modification. The reconfigurable control architecture must take into account structural, thermal, and propulsion dynamics

Given recent successes in open-loop flow control, separation control and virtual aerodynamic shaping - the use of aerodynamic flow control devices to significantly alter the flow field in lieu of modification of the physical shape of the body - are now achievable goals. The use of sensors and actuators to intelligently control the flow of air over aerodynamic surfaces offers the potential of enhanced flight capability for both autonomous and manned air vehicles. Laboratory experiments have demonstrated that flow control devices can yield reduced drag, increased lift, and control of unsteady aerodynamics. These effects could result in reduced fuel consumption, increased range/endurance, increased control authority, control without hinged surfaces, and enhanced maneuverability for future manned and unmanned air vehicles. The purpose of this program is to integrate feedback controller synthesis with aerodynamic flow control methods, which will be required to realize the full benefits of aerodynamic flow control. The integration of feedback control, including sensing some measure of the state of the flow field, is necessary for effectively and efficiently applying flow control actuation over a range of flight conditions and vehicle attitudes. Techniques for modeling the flow field and its reaction to control inputs that are amenable for control law design and evaluation are necessary for control law design.

A major goal within AFRL is to establish cooperative relationships with external researchers as part of the Scientific and Technical Workforce for the 21st century (STW-21) initiative, which is a new way of enhancing technology development using collaboration. We wish to pursue a collaborative effort in Control Science with a collaborator of high national reputation. The objective of the collaboration is to provide research in dynamics and control through a broad base of expertise with emphasis on fast reaction time to critical technical problems. The collaborative research is expected to further the new inter-disciplinary research areas of unique interest to the Air Force; for example, faculty members at universities can hire top graduate students and formulate research projects of current interest to AFRL. By conducting this collaborative research effort, AFRL can tap into the required expertise to help accelerate current research in control science in a variety of application areas. Once the program structure is

established, AFRL will then have the flexibility to rapidly respond to new research directions as the needs of the Air Force dictate.

The collaborative effort will be an extension of our in-house Center. It is envisioned that there will be a large amount of interaction between the collaborative researchers and AFRL researchers. This interaction will include regular weekly on-site visits and frequent short-notice visits, and as such, will require that researchers be able to travel quickly and on short notice between locations. This allows the research to be more focused and establishes a synergistic working relationship with the AFRL personnel that can significantly raise productivity. This close relationship with AFRL also maximizes transition opportunities for the collaboratively-developed technologies.

The collaborative research will begin with an approximately one-week kickoff period at Wright Patterson AFB in which researchers will visit the Control Science Center and have detailed meetings so that technical problems and proposed solutions can be fully understood by all the team members. Annual reviews held at the collaborative research site will be augmented by semi-annual reviews at Wright Patterson AFB, as well as numerous less formal meetings throughout the period of performance.

A plan for future strategy for long term growth in the collaborative control science research area is required.

2. Deliverable Items:

a. Data Items:

- Final Report
- Contractor's Billing Voucher
- Funds and Man-Hour Expenditure Report
- Contract Funds Status Report
- Presentation Material

b. Software: N/A

c. Hardware: N/A

3. Schedule:

- a. Overall effort: 36 months (includes 32 months for technical effort and 4 months for Final Report) with contract start 29 Sept 2001.**

4. Other Requirements

- a. This is an unclassified effort.**
- b. TEMPEST N/A**
- c. International Traffic in Arms Regulations (ITAR) (export control) does not apply.**
- d. PL 98-94 (export control) does not apply.**

e. Government Furnished Property (GFP): No government furnished property will be provided.

SECTION B: Award Information

1. Expected Award Date: 29 September 2001
2. Anticipated funding for the program: FY01: \$500K, FY02: \$1,000K, FY03: \$1,000K, FY04: \$500K. *This funding profile is an estimate only and is not a promise for funding as all funding is subject to change due to Government discretion and availability.*
3. Type of Contract/Instrument: Cost reimbursement is anticipated. However, all types of cost contracts or assistance instruments will be considered. The Air Force reserves the right to award a contract or assistance instrument. See Section D below.
4. Multiple awards are not anticipated

SECTION C: Proposal Preparation Instructions

1. General Instructions:

Offerors should apply the restrictive notice prescribed in the provision of FAR 52.215-1(e) Instructions to Offerors--Competitive Acquisition. Offerors should consider proposal instructions contained in the AFRL PRDA/BAA Guide for Industry, which can be accessed on line at www.wrs.afrl.af.mil/contract. This guide was specifically designed to assist offerors in understanding the PRDA/BAA proposal process.

Technical/management and cost volumes should be submitted in separate volumes, and must be valid for 180 days. Proposals must reference the above announcement number. Offerors must submit one original and three copies of their proposals. *Offerors are advised that only contracting officers are legally authorized to contractually bind or otherwise commit the government.* The cost of preparing proposals in response to this BAA is not considered an allowable direct charge to any resulting or any other contract; however, it may be an allowable expense to the normal bid and proposal indirect cost as specified in FAR 31.205-18.

2. Technical/Management Proposal:

a. Page Limitation: 25 pages, 10 pitch or larger, double spaced, single-sided, 8.5 by 11 inches. This limitation includes all information, e.g., indices, photographs, foldouts, appendices, attachments, etc. It does not apply to the offeror's proposed Statement of Work (SOW), which is limited to 5 pages. The government will not consider pages in excess of this limitation.

b. The proposal shall include a discussion of the nature and scope of the research and the technical approach. Additional information on prior work in this area, descriptions of available equipment, data and facilities and resumes of personnel who will be participating in this effort should also be included as attachments to the technical proposal. This volume shall include a SOW detailing the technical tasks proposed to be accomplished

under the proposed effort and suitable for contract incorporation. *Do not include any proprietary information in the SOW.* Refer to the AFRL PRDA/BAA Guide for Industry referenced above to assist in SOW preparation.

c. Any questions concerning the technical proposal or SOW preparation shall be referred to the Technical POC cited above.

3. Cost/Business Proposal:

a. Separate the proposal into a business section and cost section. Adequate price competition is anticipated. The business section should contain all business aspects to the proposed contractual or instrument arrangements, such as type of contract/instrument, any information not technically related, etc. If selected for negotiations, qualifying offerors may be required to submit a subcontracting plan. Cost proposals have no limitations; however, offerors are requested to keep cost proposals to 25 pages as a goal. The proposal shall be furnished with supporting schedules and shall contain a personhour breakdown per task. Refer to the AFRL PRDA/BAA Guide for Industry for detailed proposal instructions.

SECTION D: Basis for Award

The selection of one source for award will be based on an evaluation of each offeror's proposal (both technical and cost/price aspects) to determine the overall merit of the proposal in response to the announcement. The technical aspect, which is ranked as the first order of priority, shall be evaluated based on the following criteria that are of descending importance:

TECHNICAL:

- a. Scientific and technical merit of the proposal including soundness of the proposed Statement of Work.
- b. Creative and new approaches to the problem
- c. Understanding of the technical problems and proposed solutions in each of the four key areas of interest to the Control Science Center, including cooperative control of groups of unmanned air vehicles and satellites, control of reusable, hypersonic launch vehicles, and aerodynamic flow control.
- d. Background and experience of the key personnel. The proposed staffing in each of the areas of current interest (cooperative control of groups of unmanned air vehicles and satellites, control of reusable, hypersonic launch vehicles, and aerodynamic flow control) will be evaluated.
- e. Demonstration that the proposed work will be cooperative in nature.
- f. Demonstration of how the proposed research will further Air Force Research Laboratory technical and STW-21 goals.
- g. The plan for continued collaborative research including the strategy for long term growth in control science research will be evaluated.
- h. Adequacy of the offeror's laboratory facilities.

COST/PRICE: Cost/Price includes the reasonableness and realism of the proposed cost and fee and consideration of proposed budgets and funding profiles. Cost/Price is a substantial factor, but ranked as the second order of priority.

Proposal Risk Assessment: Proposal risk will be individually assessed for the technical, cost and schedule areas. Proposal risk relates to the identification and assessment of the risks associated with an offeror's proposed approach as it relates to accomplishing the proposed effort. Tradeoffs of the assessed risk will be weighed against the potential payoff.

No other evaluation criteria will be used. The technical and cost proposals will be evaluated at the same time. The Air Force reserves the right to select for award of a contract or assistance instrument any, all, part or none of the proposal received. Award of a grant to universities or nonprofit institutions, or assistance instrument in lieu of a contract will be subject to the mutual agreement of the parties. The government also reserves the right to award any resulting contract pursuant to the Research and Development Standard Contract format in DFARS 235.70.

SECTION E: OTHER INFORMATION TO OFFERORS:

a. An Ombudsman has been appointed to hear concerns from offerors or potential offerors during the proposal development phase of this acquisition. The purpose of the Ombudsman is not to diminish the authority of the program director or Contracting Officer, but to communicate Contractor concerns, issues, disagreements, and recommendations to the appropriate government personnel. When requested, the Ombudsman shall maintain strict confidentiality as to the source of the concern. The Ombudsman does not participate in the evaluation of proposals or in the selection decision. Interested parties are invited to contact Lt. Col. Sam A. Lopez, AFRL/PK, telephone (937) 255-4813, e-mail sam.lopez@wpafb.af.mil . All routine communication concerning this acquisition should be directed to Dennis Strobel, Contract Negotiator, telephone (937) 656-9617.

b. Based upon market research, the Government is not using the policies contained in Part 12, Acquisition of Commercial Items, in its solicitation for the described supplies or services. However, interested persons may identify to the contracting officer their interest and capability to satisfy the Government's requirement with a commercial item within 15 days of this notice.